

Output tables for the test of Multiple comparisons.

December 17, 2022

1 Average rankings of Friedman test

Average ranks obtained by applying the Friedman procedure

Algorithm	Ranking
MEABC	6.2069
ABCADDE	3.7931
ABCNG	4.931
SHADE	3.2931
MAPSO	4.5172
TAPSO	3.6552
MEEABC	1.6034

Table 1: Average Rankings of the algorithms

Friedman statistic considering reduction performance (distributed according to chi-square with 6 degrees of freedom: 77.116995.
P-value computed by Friedman Test: 7.584965988627346E-11.

2 Post hoc comparisons

Results achieved on post hoc comparisons for $\alpha = 0.05$, $\alpha = 0.10$ and adjusted p-values.

2.1 P-values for $\alpha = 0.05$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm
21	MEABC vs. MEEABC	8.114539	0	0.002381
20	ABCNG vs. MEEABC	5.865566	0	0.0025
19	MAPSO vs. MEEABC	5.136169	0	0.002632
18	MEABC vs. SHADE	5.136169	0	0.002778
17	MEABC vs. TAPSO	4.497947	0.000007	0.002941
16	MEABC vs. ABCADE	4.254815	0.000021	0.003125
15	ABCADE vs. MEEABC	3.859725	0.000114	0.003333
14	TAPSO vs. MEEABC	3.616593	0.000299	0.003571
13	SHADE vs. MEEABC	2.97837	0.002898	0.003846
12	MEABC vs. MAPSO	2.97837	0.002898	0.004167
11	ABCNG vs. SHADE	2.887196	0.003887	0.004545
10	MEABC vs. ABCNG	2.248973	0.024514	0.005
9	ABCNG vs. TAPSO	2.248973	0.024514	0.005556
8	SHADE vs. MAPSO	2.157799	0.030943	0.00625
7	ABCADE vs. ABCNG	2.005841	0.04873	0.007143
6	MAPSO vs. TAPSO	1.519577	0.128617	0.008333
5	ABCADE vs. MAPSO	1.276444	0.201798	0.01
4	ABCADE vs. SHADE	0.881354	0.378126	0.0125
3	ABCNG vs. MAPSO	0.729397	0.465759	0.016667
2	SHADE vs. TAPSO	0.638222	0.523329	0.025
1	ABCADE vs. TAPSO	0.243132	0.807903	0.05

Table 2: P-values Table for $\alpha = 0.05$

Holm's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.005 .

2.2 P-values for $\alpha = 0.10$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm
21	MEABC vs. MEEABC	8.114539	0	0.004762
20	ABCNG vs. MEEABC	5.865566	0	0.005
19	MAPSO vs. MEEABC	5.136169	0	0.005263
18	MEABC vs. SHADE	5.136169	0	0.005556
17	MEABC vs. TAPSO	4.497947	0.000007	0.005882
16	MEABC vs. ABCADE	4.254815	0.000021	0.00625
15	ABCADE vs. MEEABC	3.859725	0.000114	0.006667
14	TAPSO vs. MEEABC	3.616593	0.000299	0.007143
13	SHADE vs. MEEABC	2.97837	0.002898	0.007692
12	MEABC vs. MAPSO	2.97837	0.002898	0.008333
11	ABCNG vs. SHADE	2.887196	0.003887	0.009091
10	MEABC vs. ABCNG	2.248973	0.024514	0.01
9	ABCNG vs. TAPSO	2.248973	0.024514	0.01111
8	SHADE vs. MAPSO	2.157799	0.030943	0.0125
7	ABCADE vs. ABCNG	2.005841	0.044873	0.014286
6	MAPSO vs. TAPSO	1.519577	0.128617	0.016667
5	ABCADE vs. MAPSO	1.276444	0.201798	0.02
4	ABCADE vs. SHADE	0.881354	0.378126	0.025
3	ABCNG vs. MAPSO	0.729397	0.465759	0.033333
2	SHADE vs. TAPSO	0.638222	0.523329	0.05
1	ABCADE vs. TAPSO	0.243132	0.807903	0.1

Table 3: P-values Table for $\alpha = 0.10$

Holm's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.01 .

2.3 Adjusted p-values

i	hypothesis	unadjusted p	p_{Holm}
1	MEABC vs .MEEABC	0	0
2	ABCNG vs .MEEABC	0	0
3	MAPSO vs .MEEABC	0	0.000005
4	MEABC vs .SHADE	0	0.000005
5	MEABC vs .TAPSO	0.000007	0.000117
6	MEABC vs .ABCADE	0.000021	0.000335
7	ABCADE vs .MEEABC	0.000114	0.001703
8	TAPSO vs .MEEABC	0.000299	0.004179
9	SHADE vs .MEEABC	0.002898	0.037672
10	MEABC vs .MAPSO	0.002898	0.037672
11	ABCNG vs .SHADE	0.003887	0.042756
12	MEABC vs .ABCNG	0.024514	0.245142
13	ABCNG vs .TAPSO	0.024514	0.245142
14	SHADE vs .MAPSO	0.030943	0.247548
15	ABCADE vs .ABCNG	0.044873	0.314112
16	MAPSO vs .TAPSO	0.128617	0.771704
17	ABCADE vs .MAPSO	0.201798	1.008992
18	ABCADE vs .SHADE	0.378126	1.512504
19	ABCNG vs .MAPSO	0.465759	1.512504
20	SHADE vs .TAPSO	0.523329	1.512504
21	ABCADE vs .TAPSO	0.807903	1.512504

Table 4: Adjusted p -values